# A universal adhesive containing copper nanoparticles improves the bonding and mechanical properties of resin cement–root dentin interface: an in vitro study


- Gutiérrez, Mario F.[a, b];
- Ñaupari-Villasante, Romina[c];
- Bedoya-Ocampo, Jessica[c];
- Nuñez, Alejandra[c, d];
- Fernández, Eduardo[e, f];
- Loguercio, Alessandro D.



## Abstract

The aim of this study was to evaluate the anti-MMP activity of two concentrations of copper nanoparticles (CuNp) and the effect of their addition to a universal adhesive system on resin cement-radicular dentin in situ degree of conversion (DC), elastic modulus (EM), nanoleakage (NL), and push-out bond strength (PBS). Anti-MMP activity was evaluated for several MMPs. Seventy-two roots of endodontically prepared human lower premolars were randomly divided into six groups according to CuNp concentration (0% [control], 0.1%, 0.2%) and adhesive strategy (etch-and-rinse [ER] and self-etch [SE]). Fiber posts were cemented, DC was measured using micro-Raman spectroscopy, the EM of the hybrid layer and adhesive layer was measured using a nano-indenter, the NL was evaluated by scanning electron microscopy, and PBS was tested at 0.5 mm/min. Data were analyzed by two-way ANOVA and Tukey's test ($\alpha = 0.05$). CuNp demonstrated anti-MMP activity ($p < 0.01$). CuNp containing-adhesives showed significant increased DC ($p = 0.01$), increased EM in the hybrid layer and adhesive layer ($p = 0.001$), decreased NL values ($p = 0.001$), and increased PBS ($p = 0.0001$). Adhesive strategy was not statistically significant ($p > 0.47$). Usually, a significant difference among root thirds was observed, except for DC and NL when CuNp 0.2% was evaluated. This is the first in vitro study showing that the incorporation of CuNp in an adhesive is an achievable alternative that can provide anti-MMP activity and improve the mechanical and bonding properties to root canal dentin. © 2023 Informa UK Limited, trading as Taylor & Francis Group.



## Author keywords

copper; metalloproteinases; nanoleakage; nanoparticles; push-out bond strength; Universal adhesive system